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To: C. H. Rowe, Jr. **Date:** July 8, 1992

From: J. O. Stimler

Subject: Implementation of Feasibility Study of Physical Methods for Blend Composition Analysis

The ability to perform blend composition on a single rod has been an elusive goal for many years. Current CTSD methods are a step in this direction, but they are limited by the capabilities of the human eye and human tolerance factors. Chemical methods increase the information content in certain dimensions but require a larger ground sample, degrading the input materials. Proposed spectroscopic methods also degrade the sample through the grinding process. It can be argued that the proposed physical method is the most desirable procedure because of its non-destructive nature and its broader applicability to competitive products, as well as incremental extension to additional blend components. A recent JTI patent indicates that they have conducted a major interdisciplinary effort and successfully applied the methods of image analysis to classification of burley leaves by stalk position and quality of leaf. A second JTI patent, not yet received in translated form, reportedly does the same for bright leaves.

The central question to be answered by this feasibility study is the following: "Can image analysis and pattern recognition techniques be applied to a rod level sample of tobacco filler and used to discriminate the components of ES, RL and RCB in a manner similar to current CTSD practice?"

Although previous experiences by Analytical Microscopy and CTSD with image analysis were only partially successful, considerable evidence exists that the objective of this study is achievable. The JTI effort mentioned above has a significant degree of similarity and is of the same level of difficulty. During a recent review of the CTSD method with Nancy Ryan, it was observed that the discrimination of blend components was largely conducted in a single plane and on one tobacco shred at a time. This study will use a similar approach but substitute a color camera and appropriate computer hardware and software for the human eye. Given the rapid evolution of image analysis, pattern recognition, and expert systems techniques - particularly within R&D - the motivation and probability for success using this approach are substantial. Of course, significant obstacles are expected to be encountered during this study. The resolution of cameras available to us, without purchasing additional equipment, may not be sufficient to pick up the level of detail required for discrimination in some cases. If so, we will attempt to lay out the direction and discuss the results expected to be obtained with more sophisticated equipment. Some tobacco components are expected to be harder to discriminate than others. We will develop the discrimination capabilities to the extent possible during the period of this feasibility study and point the direction for possible future investigations. A review of the JTI patent indicates a sophisticated discrimination capability was developed. Such a capability, while possible and even desirable, is beyond that proposed during this initial study. It is assumed that the engineering development required to transform this initial work

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into a routine analytical procedure will be addressed at a later time. These concerns not withstanding, the probability of a successful outcome is considered relatively high. A step-by-step approach for this study is outlined below.

Feasibility Task Plan

Task	Description	Week 1 2 3 4 5 6 7 8 9 10 12 14 16
A	Collect equipment and assemble system McRae, Stimler	xxxxxx
B	Collect pure cased components Bokelman	xxx
C	Study individual components Stimler, McRae, Blankinship, Bokelman	xxxxxxxxxxxxxxxx
D	Develop discriminating characteristics Stimler, McRae, Blankinship	xxxxxxxxxxxxxx
E	Develop discriminating functions Stimler, Blankinship	xxxxxxxxxxxx
F	Discriminate pure components Stimler, Blankinship	xxxxxx
G	Discriminate known blends Stimler, Blankinship, Bokelman	xxxxx
H	Compare with CTSD capability Ryan, Stimler, Bokelman	xxx
I	Report results All	xx

cc:
R. Adkins
S. Baldwin
J. Blankinship
G. Bokelman
R. Comes
C. Ellis
R. Fenner
P. Grantham
H. Grubbs
R. Heretick
D. Leyden
D. McRae
N. Ryan
J. Whidby

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